himself, who was struck with three arrows, which his companion (Lieutenant Tappenbeck) cut out with a razor. The land journey was then abandoned, and the river descended in boats to the Congo. The German accounts of this expedition call attention to the fact that in many of the names of tribes, etc., those mentioned by the Portuguese missionaries may be recognized; also to the similarity between the names of tribes in this region and those of others dwelling on the Cunene or Zambezi (*i.e.*, Adima, Pende, Bayeye, Balula, Basaka, Bangola). This points either to similarity of language, or to an extensive migration of tribes.

AFRICAN NOTES.—Mr. H. H. Johnston made a journey up the Cameroons River in June last. A few miles beyond the village of Ngale Nyamsi, he obtained, from a height of five hundred feet above the river, a view of a chain of fantastically peaked mountains lying fifty to sixty miles from the river and probably ten thousand feet or more in height.

M. J. de Brazza, brother of the governor of the French Congo, reached the Sekoli (the Punga of Grenfell) by an overland journey from the Ogowé through a fertile and well-populated region, the abode of the Mbete and Ossete tribes. On the Sekoli dwell the Ikata, a commercial but warlike people. The river was descended in canoes to where it receives the Amboli and assumes larger proportions.

The French gunboat "Niger" made a voyage in the autumn of 1885 from Kulikoro to Jenne, on the Upper Niger. This part was only known from the accounts of Mungo Park and René Caillé. The once populous town of Sansandig, a considerable commercial centre in Park's time, is now a heap of ruins, having fallen a prey to the Tukaleurs. M. Davoust placed all the tribes on the left bank under French protectorate. Those on the right are ruled by Ahmadu, the Tukaleur chief.

The Rev. G. Grenfell lately read before the Royal Geographical Society of London an account of his recent explorations in the steamer "Peace." He mentions the discovery by Dr. Wolff of a river known as the Lomami which falls into the Sunkuru from the northeast, but does not believe it identical with the river of that name which flows into the Congo just below Stanley Falls, which he himself ascended as far as 1° 33 S. lat. in January, 1885; and which at that point was a stream of thirty-five thousand feet per second, at an altitude of thirteen hundred and fifty feet above the sea.

## GEOLOGY AND PALÆONTOLOGY.

**Hyatt on Primitive Forms of Cephalopods.**[1]—The succession of forms in any genetic series of Nautiloids is from a straight shell through a curved cyrtoceran form to a loose-coiled gyroce-

[1] Abstract of a paper read before the National Academy of Science, Boston meeting, by Alpheus Hyatt.

ran, and finally to a close-coiled nautilian shell. Among Ammonoids the same series occurs only on one occasion, at the beginning of the group, during Silurian and Devonian time, in a series which may be said to include Bactrites, a straight orthoceratitic shell, Mimoceras, a true gyroceran form, and Anarcestes, which is close-coiled. The discovery of a proto-conch upon the apex of Bactrites by Beyrich and Branco leaves no doubt that it is, as heretofore supposed by the writer, a transitional form from Orthoceras to Ammonoidea. These forms are primitive or transitional radicals and have cylindrical whorls, except in Anarcestes. In this genus a depressed semilunar whorl is for the first time introduced. This form of whorl is not at once and generally adopted in the young. On the contrary, these are usually tubular and often straight like Bactrites, or loosely coiled like the adults of Mimoceras. Others, again, after passing through a stage with tubular whorls, may become suddenly close-coiled and have at once a depressed form of whorl. Such fluctuations in embryonic characters are common even in different varieties of the same species until we reach the Trias. In this formation, or possibly earlier in the Dyas, the larvæ are all close-coiled, and the whorls at an early stage invariably have the depressed semilunar form like the adults of Anarcestes. Throughout the Trias also there occur in great abundance smooth shells, Arcestes, in which the full-grown adults are smooth and have the similar anarcestian peculiarities. Thus from the Silurian to the Trias, inclusive, the semilunar or depressed smooth whorled forms are continuous. These make up a central trunk of stock forms, which we have designated as primary radicals, confining the use of the words primitive radicals to the transitional genera Bactrites, Mimoceras, and the like.

Compressed forms differing but slightly from the depressed species occur in Anarcestes and in Arcestes, etc. In the Trias and Lias these compressed, smooth shells which we have called secondary radicals become much more important. In Psiloceras planorbe we strike upon a species of this character to which we can trace all the Arietidæ of the lower Lias and many forms of higher Jura and Cretaceous.

The great trunk of radical species has, of course, many lateral branches, which strike off from it during the course of its chronological migrations through the Palæozoic and Trias, but of these we have taken no account, because they were purely lateral offshoots which did not arise from fission or the modification of the main stock of radical generators. In the Jura, however, this main stock itself splits into branches, and the primary and secondary radical forms are replaced by more complicated radicals.

There is a side branch, which arose in the early Trias, and in which they are still, in a measure, preserved and continued, but

the main trunk line is replaced by irregular branches beginning with species which we have styled tertiary radicals. These have either the depressed or compressed form of whorl, are discoidal, and, therefore, resemble the primary and secondary radical throughout life. But, on the other hand, they are often highly ornamented with spines and ribs, and have more complicated sutures.

The tertiary radicals give rise to series of species, which may become excessively involute and otherwise modified in the higher forms, but these are never the radical generators of new forms or new series. There are, therefore, no quaternary radicals to continue the direct lines of descent from the Trias, so far as progressive forms are concerned.

But when we turn our attention to retrogressive forms, the story is different. Series of degraded or distorted forms occur in the Jura and Cretaceous, and several families afford good examples. In these series we can usually trace an origin in some close-coiled, discoidal, ornamented shell, which belongs to the tertiary radicals, or is not far removed from them in its aspect.

We have frequently pointed out the nature of these degradations. They are similar to the senile degenerations observed in the individuals of the tertiary radicals and other species of the progressive series of the Ammonoids. These geratologous transformations, whether occurring in the senile degenerations of a shell or in a series of species, tend to produce similar results, namely, the decrease in size and uncoiling of the whorl, destruction of ribs and spines, reduction of sutures to more primitive proportions. The final result, as we have often said, is a straight almost smooth shell, Baculites. We now wish to assert that Baculites is a polyphyletic group derived from many tertiary radicals, and separable into a considerable number of distinct genetic groups.—*Alpheus Hyatt.*

**New Jersey Cretaceous.**—The different beds of the New Jersey Cretaceous consist of layers of sedimentation, almost always conformable, which have been distinguished by the State Geological Survey as Plastic Clays, Camden Clays, Lower Marls, Middle Marls, Upper Marls, with which series in this paper the Eocene Marls have been united. Beds of sand separate these beds, and the fossils are limited to the green marls and clays. The clay-beds in their lower part have yielded five species of fossils, shells which are entirely estuarine in character, the genera recognized being Astarte, Corbicula, Gnathodon, and a new genius, Ambonicardia. This last genus resembles the Jurassic forms of Europe.

At the upper limit of the clay-beds in the clay marls are found iron-stone nodules containing casts of fossils identical with Lower Marl fossils, or with those from the Clay Marls at Cross-

wicks and Haddonfield. Their position may be in the Lower Marl-beds or in the clays proper. More study and investigation is necessary to determine this point. Lower down in the clay fossil plants occur cretaceous in character (Newberry).

The Lower Green Marls hold most of the cretaceous fossils, and this fact, together with a showing of the comparative richness in fossils of the entire series discussed, is made evident by the following tables:

*Summary of Lamellibranchiata.*

| Formations. | Families. | Genera. | Species. |
|---|---|---|---|
| Plastic Clays | 4 | 4 | 5 |
| Camden Clays | 1 | 2 | 12 |
| Lower Marls | 27 | 76 | 155 |
| Middle Marls | 8 | 9 | 11 |
| Base of Upper Marls | 12 | 13 | 16 |
| Eocene Upper Marls | 12 | 17 | 23 |
| Total | 31 | 89 | 222 |

*Summary of Gastropods.*

| Formations. | Families. | Genera. | Species. |
|---|---|---|---|
| Plastic Clays | ... | ... | 1? |
| Camden Clays | ... | ... | .. .. |
| Lower Marls | 25 | 60 | 125 |
| Middle Marls | 5 | 6 | 7 |
| Base of Upper Marls | 7 | 8 | 8 |
| Eocene Upper Marls | 21 | 29 | 52 |
| Total | 31 | 80 | 190 |

*Summary of Cephalopods.*

| | Species. |
|---|---|
| Lower Marls | 11 |
| Middle Marls | 1 |
| Eocene Marls | 2 |

*General Summary of Species.*

| | Cretaceous. | Eocene. |
|---|---|---|
| Brachiopods | 5 | 2 |
| Lamellibranchiata | 199 | 23 |
| Gastropoda | 138 | 52 |
| Cephalopoda | 12 | 2 |
| Total | 354 | 79 |

The fossils are usually restricted to single beds, at most only four molluscan forms, passing from one bed to another. The zoological break is conspicuous, but is accompanied by no geological unconformity, a slight exception to this being seen only at the junction of the Eocene Marl-beds and the layers immediately below it. The brachiopods, so common a feature in the Cretaceous of Europe, are proverbially rare in American strata of this age, only five species being recognized, all Terebratulidæ.

Of the brachiopods, *Terebratula harlani* and *T. lachryma* occur in South Carolina, and *T. floridana* in Alabama.

Of Lamellibranchiates of the Lower Marl-beds of New Jersey,—

| | | | |
|---|---|---|---|
| 41 | species | are known from | Alabama. |
| 21 | " | " | Tennessee. |
| 21 | " | " | Mississippi. |
| 6 | " | " | Texas. |
| 20 | " | " | North Carolina. |
| 4 | " | " | Dakota. |
| 3 | " | " | Europe. |

Of the Middle Marl-bed species,—

| | | | |
|---|---|---|---|
| Alabama | has | 3 | species. |
| Tennessee | " | 1 | " |
| Texas | " | 1 | " |
| Dakota | " | 1 | " |

Of the Eocene species, *Crassatella alta* is the only species known from any other State.

Of the Gastropods, which have been less studied in the Southern States,—

| | | | |
|---|---|---|---|
| North Carolina | has | 1 | species. |
| Tennessee | " | 2 | " |
| Alabama | " | 12 | " |
| Mississippi | " | 7 | " |
| Texas | " | 1 | " |

Of the Cephalopods, most have been recognized in Alabama and Texas. Of the Eocene Gastropods, ten occur in Alabama.

Of the two hundred and twenty-two species of Lamellibranchiates, seventy-four of them are new species; and of one hundred and ninety species of Gastropods, one hundred and seven are new. Comparison permits the conclusion arrived at before by others on less extensive determinations, that the New Jersey Cretaceous Marls are the equivalent of No. 4 or of Nos. 4 and 5 of the Upper Missouri Section.

The work done on the Cretaceous is yet fragmentary, as many specimens are too imperfect for use, and the middle and base of the upper marls have not been systematically examined.—*R. P. Whitfield.*

**Geological News.** GENERAL.—A catalogue of the Blastoidea in the Geological Department of the British Museum of Natural History is the joint work of Mr. R. Etheridge and Mr. P. H. Carpenter. The Blastoids are given a position as a group equivalent in rank to the brachiate Crinoids. The term Pelmatozoa, or palmed animals, includes the crinoids and cystids, and the class Blastoidea have the following peculiar characters among others: A subambulacral lancet-plate which is pierced by a canal that lodged the water-vessel, the absence of under-basal plates, the constant presence of five interradials, the constant but peculiar trimerous symmetry of the base, a character previously observed

only in one cystid and possibly in one crinoid, and the very symmetrical grouping of the hydrospires, which are limited to the radial and interradial plates, and have their slits parallel to the ambulacra. The Blastoids are the most regular of Echinoderms. All have thirteen plates except Pleacrinus, in which one is divided.

SILURIAN.—E. O. Ulrich has published descriptions of new Silurian and Devonian fossils, chiefly Polyzoa, and describes as new genera Busiopora and Lichenotrypa.

PALÆOZOIC.—Rohon and Zittel have recently studied the histological structure of the conodonts. As a result, they declare that they differ entirely from true teeth or the so-called teeth of lampreys and of Mollusca, and do not resemble any part of the hard parts of Crustacea, but they agree closely with the teeth of Annelid and Gephyrean worms.

TERTIARY.—The second number of the Annals of the New Natural History Museum at Vienna contains an important paper upon the Miocene pteropods of Austro-Hungary, by Ernst Kittl. Illustrations of most of the species are given, and ten new species described.

PLIOCENE.—The flora of the Cromer Forest-bed (England) has been investigated by Mr. Clement Reid, who found in various samples of dark peaty sandy clays, the seeds or fruits of forty species of dicotyledons, eighteen of monocotyledons, five of gymnosperms, and three cryptograms, besides some mosses and Characeæ. With a few exceptions, the same plants still exist in the locality.

QUATERNARY.—Professor Lindström believes, from the configuration and structure of the rock-terraces in Gottland, Sweden, that the island received its present form by denudation, previous to the Glacial period, and that various changes of level have taken place since that time. Raised beaches are traced in Gottland at various elevations up to two hundred and fifty-nine feet above sea-level, the highest point on the island. Erratic bowlders are traced from the Aland Isles, possibly from the southwest of Finland, and from the bed of the Baltic.

Dr. Nathorst gives his adhesion to the belief that pebbles with distinctly faceted surfaces are due to the action of wind-driven sand. Mr. Travers, in 1869, first called attention to such pebbles, and thus explained their origin. Similar pebbles have been discovered in the Eophyton sandstone at Lugnas, Sweden.